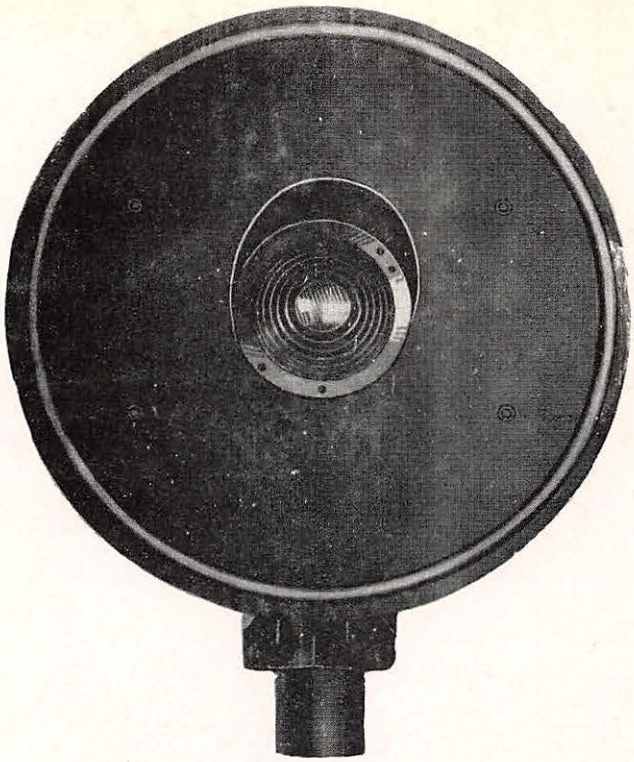


Style "H" Searchlight Signal

S.I.S.
No.151.

Union Switch & Signal Co.
Swissvale, Pa.

Rotaprinted IN U.S.A.

Union Switch & Signal Co.

SWISSVALE, PA.

Subject: Style "H" Searchlight Signal

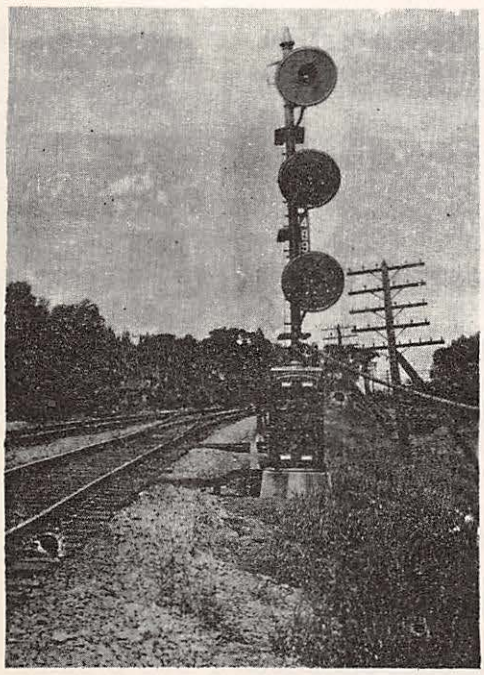
Sales Information Sheet

Number: 151

Date: April 24, 1930

15.3 Sheets

The Union Style "H" Searchlight Signal is a modified design of the original Hall Searchlight Signal, incorporating increased efficienty of optical assembly and marked improvement in the magnetic and contact structure of the operating relay. Specific improvements in the operating relay include easily inspected vertical air gaps of increased dimensions between the armature and pole faces, a magnetic circuit of non-aging iron and greater mechanical torque of the armature. Where simplicity of aspects, flexibility of application and facility of electrical control are important requisites, this signal is an answer which will be productive of reliable, economical and long service.



Style "H" Searchlight Signal "Side of Mast" Mounting

Catalog ordering references will be found on Plates B-2800 to B-2860 and Installation and Maintenance Instructions in pamphlet U-5028.

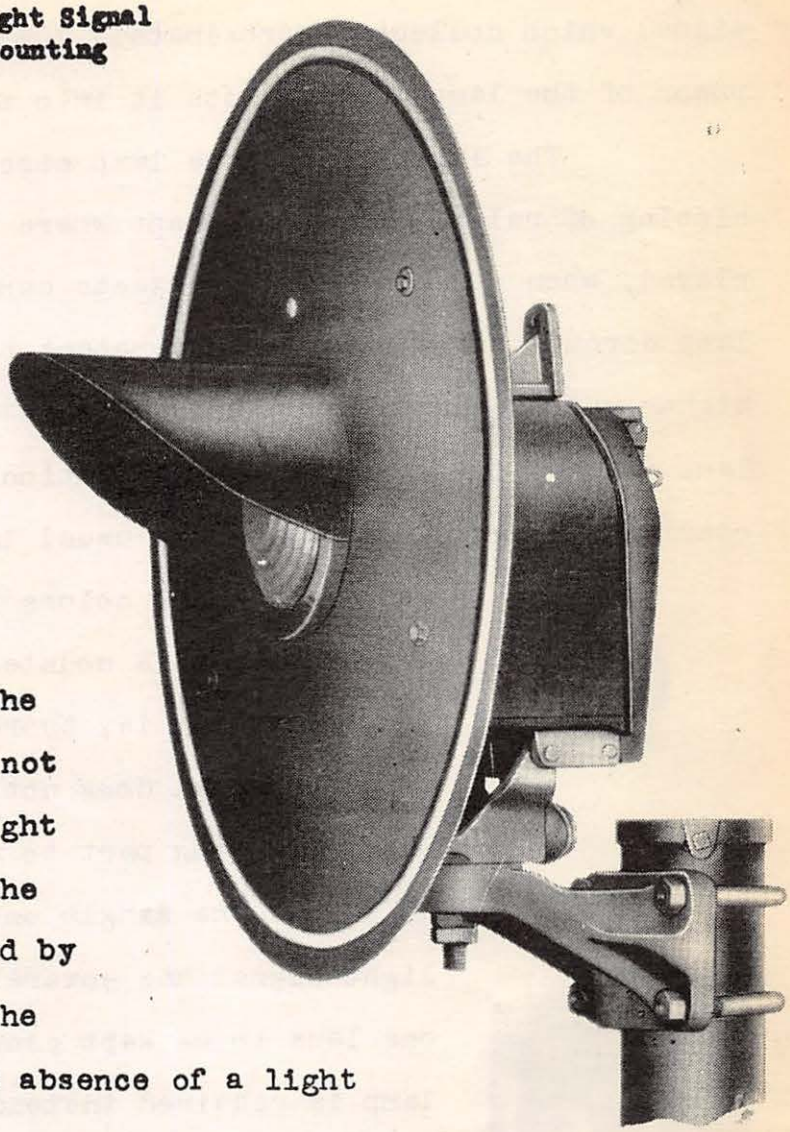
The Style "H" Searchlight Signal possesses many exceptional advantages which, while formerly recognized, have recently become impressive.

Style "H" Searchlight Signal, "Side of Mast" Mounting

All of the indications are projected through the same lens. This is desirable from the standpoint of the observer and also results in a most compact signal requiring minimum space. For two or three arm signals, this is a great advantage because the signals can be mounted lower and all indications are projected nearer to the engineman's normal line of vision. The small size of this signal is also a great advantage when one and two arm dwarf signals must be located between tracks. This is particularly important for terminal installations where dwarf signal indications, the same as high signal indications, are required.

Only one lamp is employed for three indications instead of three lamps in other types of color light signals. Whether or not the lamp is burned out, is checked by the engineman each time the signal is passed. As a signal is usually at "clear" or "caution", the element of chance greatly favors the probability that a "light-out"

Style "H" Searchlight Signal
"Top of Mast" Mounting



will be discovered when the block is clear. This is not true of other types of light signals as the lamp for the stop indication is checked by the engineman only when the block is occupied and the absence of a light is then a hazard.

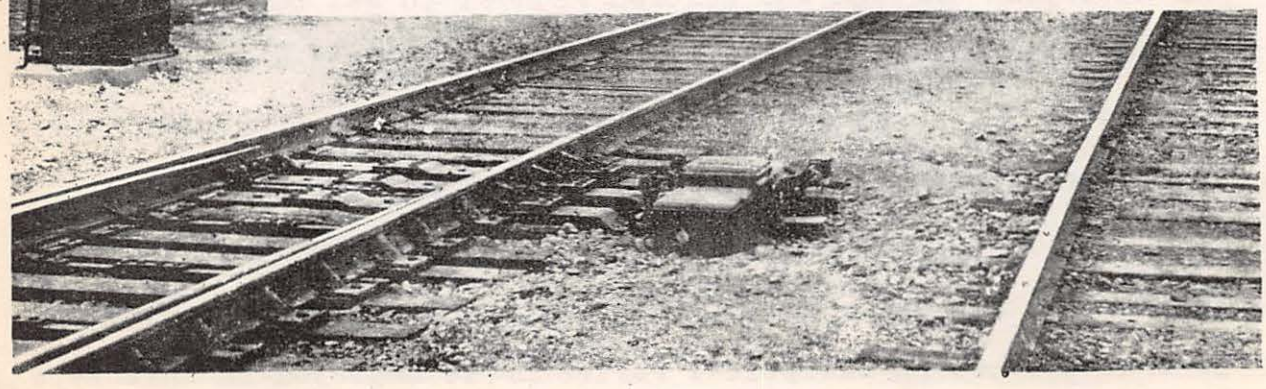
A false phantom color indication is impossible because any light projected into the signal is reflected by the mirror and must pass through the colored roundel to get out through the optical system. As the position of the colored roundels is controlled by the condition of the block, the indication will always be of the proper color.

The Style "H" Searchlight Signal is highly efficient and low wattage lamps give a very satisfactory indication. This is true because an elliptical reflector is employed in this type of

signal which collects approximately 70% of the sperical candle power of the lamp and projects it into the light beam.

The integrity of the lamp circuit does not depend on the closing of relay contacts, except where approach lighting is employed, when metal-to-metal contacts can safely be used. Thus the lamp circuit has a reasonably constant resistance and even when the higher wattage lamps are used, there is little or no variation in lamp voltage intensity of the indication displayed. The signal operating relay simply omits the usual lamp controlling contacts, and changes the colors by means of miniature colored roundels mounted on the movable element of the relay. It is, therefore, obvious that this type of signal does not add any mechanical mechanism or moving part to a signal system.

The single optical system of the searchlight signal has several advantages. There is only one lens to be kept clean instead of three and one lamp is required instead of three. Also a better close-up view of the searchlight signal lens may be had, because in other types, hoods for adjacent units interfere with the view.



Style "H" Searchlight Signal, "Top of Mast" Mounting

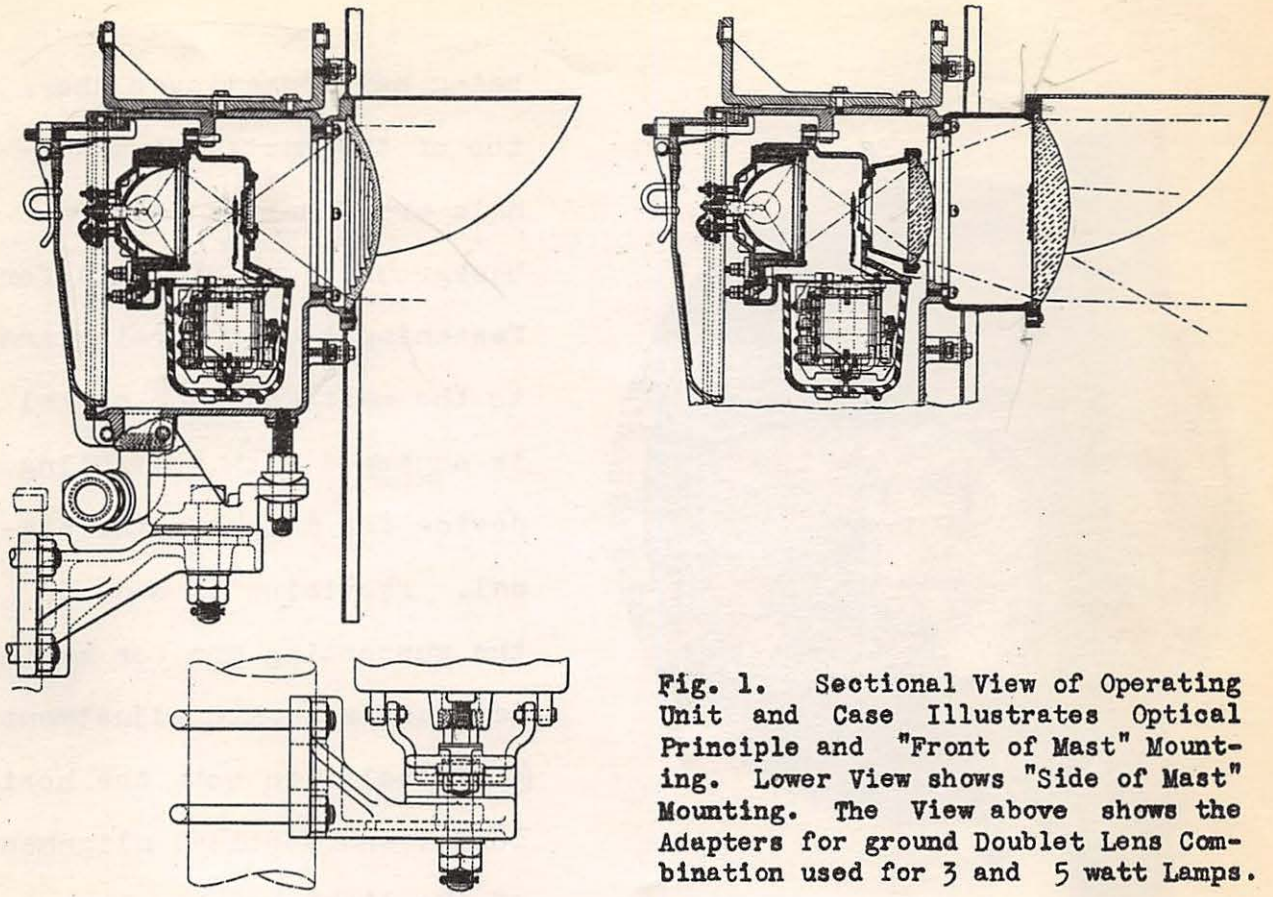


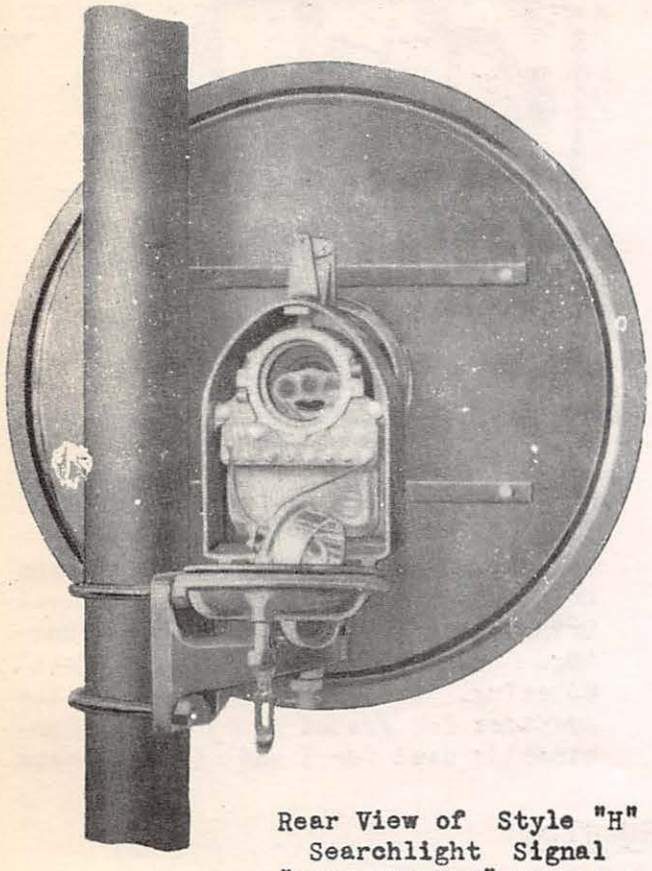
Fig. 1. Sectional View of Operating Unit and Case Illustrates Optical Principle and "Front of Mast" Mounting. Lower View shows "Side of Mast" Mounting. The View above shows the Adapters for ground Doublet Lens Combination used for 3 and 5 watt Lamps.

CONSTRUCTION

The Style "H" type color light signal consists of an outer case which includes the lens, lens hood and signal support, and an operating relay. The outer case proper is the same for all high and dwarf signals.

High Signal:

Two types of supporting arms are furnished for high signals, (see catalog Plate B-2825). One type is designed for either right or left hand"side of mast" mounting, the center line of the signal being approximately nine (9) inches from the center line of the mast. Another type of supporting arm is furnished providing for "front of mast" mounting. In this arrangement the signal is located close to the top of the mast, the case door in the open position



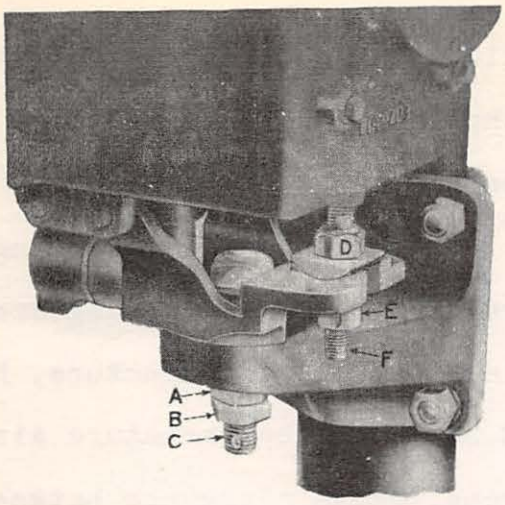
Rear View of Style "H"
Searchlight Signal
"Side of Mast" Mounting

being horizontal over the top of the mast. High signals are furnished with a background and "U" bolts for fastening the supporting arm to the mast and each signal is equipped with a sighting device for aligning the signal. Provision is made in the supporting arm for making easy and accurate adjustments (separately) in both the horizontal and vertical alignments of the light beam.

Dwarf Signal:

The dwarf signal is the same as the high signal except as to the lens and deflecting prism cover glass; it is fitted with a base suitable for mounting on a flat surface such as a concrete foundation, instead of a supporting arm, but is not provided with a background and a sighting device. Slotted holes are provided in the base so that horizontal adjustment of the light beam may be secured. Vertical alignment is obtained in the same manner as in the high signal.

View of Standard Dwarf Signal
showing the alignment
adjustments

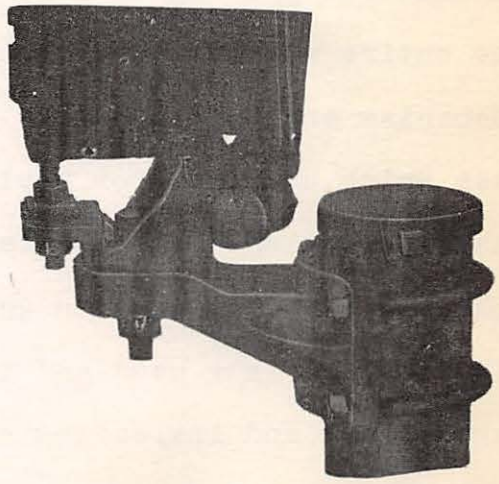


Adjustable Bracket for "Side of Mast" Mounting

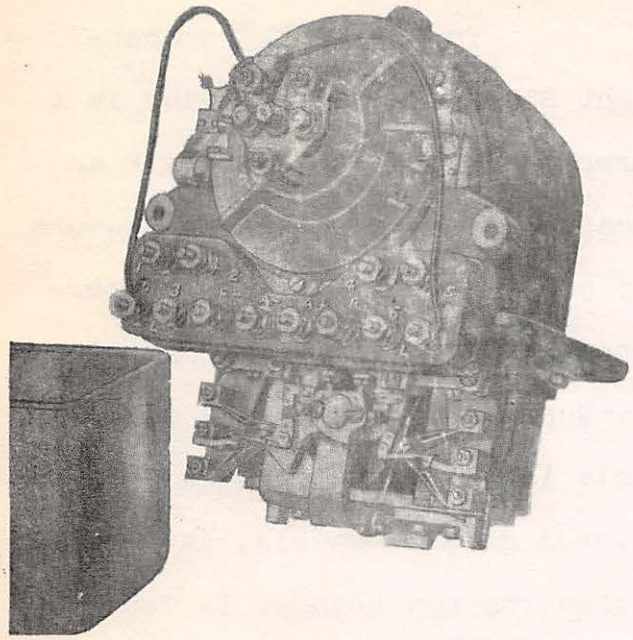
Operating Relay:

The Style "H" Searchlight Signal Operating Relay is a three-position mechanism with an armature counterweighted to assume the central position when deenergized. Directly connected to the armature shaft is a small spectacle in which are mounted three colored glass roundels, each of one inch diameter. In the central position the red roundel is located in the light beam, giving a red indication. When current is passed through the operating coil in one direction, the armature is rotated a few degrees in one direction, bringing the yellow roundel into the light beam. When the current through the armature coil is reversed, the armature is rotated in the opposite direction, bringing the green roundel into the light beam. The signal, therefore, is operated on a polarized circuit to effect the required change in colors. For two color light signaling the armature is rotated only in one direction.

Deenergizing the relay to bring the red roundel into view does not, on present signals, result in any "bobbing" or "rocking" to show colors other than red. The relay armature is practically dead beat when deener-



Adjustable Bracket for "Top of Mast" Mounting



Operating Relay
with local coils

gized and permits red only to show during the deenergized period.

The d-c. operating relay employs non-ageing iron in the magnetic structure, has 0.050" vertical armature air gaps, ample clearance between movable and stationary parts and a comparatively high mechanical torque tending to center the armature. The armature operating coil surrounds the movable armature but is not connected to it.

Full sized relay contacts are provided which may be used for repeating and checking the positions of the relay armature and for control of slow-acting relays employed for "pole-changing" the circuit for the signals in the rear. The entire working parts of the mechanism are enclosed in a glass case which provides for ample visual inspection. The greatest possible care is taken in selection of materials used and in the manufacture and inspection of this instrument, with a view of making it equally as reliable in operation as a tractive type d-c. relay.

Operating Relay with
Permanent Magnet Field

a. W. Fisher

Operating relays are usually equipped with two dependent front and back contacts. Both back contacts are closed when the relay armature is deenergized. The front contacts are closed only at the "yellow" and "green" positions of the relay respectively. The operating relay can also be furnished without contacts.

The operating relay is accurately located and fastened in the case by means of a fixed stud and two body bound bolts. The relays are interchangeable in the sense that it is not necessary that a relay be installed in a particular case.

Where it is desirable to control the relay from an a-c. circuit it is recommended that the d-c. relay be used with a suitable copper oxide rectifier.

There are two distinct types of relay mechanisms available. The type most commonly used in the past employed a pair of field coils (local circuit) to maintain a uni-directional magnetic field. A more recently developed type uses a reliable permanent magnet field structure which eliminates the coils and produces a material saving in energy required for the relay's operation.

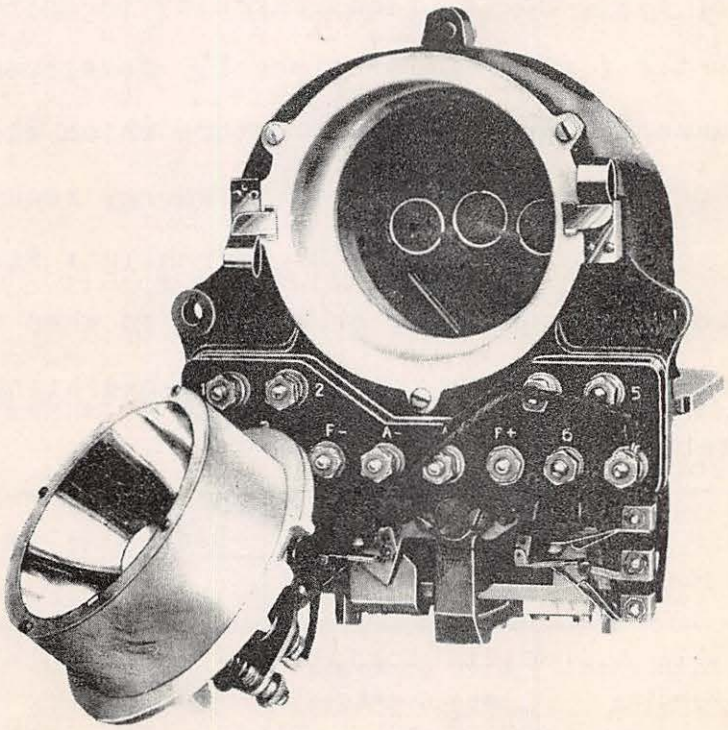
The Style "H" Searchlight Signal is very economical in power consumption, especially so when the permanent magnet type of operating relay is used. The operating values are shown in the tabulation below:

TYPE OF RELAY		Resistance Ohms		FIELD	ARMATURE VOLTS	
		Field	Armature	VOLTS	Minimum Release	Max. Pick-up
With Local Winding	With Contacts	500	250	6	2.5	6
	Less Contacts	500	250	6	3.0	6
Permanent Magnet	With Contacts		250		2.0	5.2
	" "		500		3.0	7.6
	Less Contacts		250		2.6	5.2
	" "		500		3.8	7.6

Optical Arrangement:

The light beam is concentrated at the colored roundel location by means of an elliptical glass reflector, which, with the lamp, lamp socket and reflector holder as a unit, is inserted and held in place with spring clips in the back of the relay top case. It is a characteristic of the elliptical reflector that, with the lamp filament located at the focal point of the reflector, the reflected light is concentrated at the other focal point of the complete ellipse, which in this signal relay is approximately the location of the colored roundel. After passing through the colored roundel, the beam spreads out to cover the lens in the outer case, which condenses the light rays into a concentrated beam. The lamp socket is adjusted and sealed at the factory and accurately based lamps may be placed in the socket without any readjustment.

The standard 8 3/8" diameter high signal lens has a deflecting prism formation moulded in the center, and on the inside of the lens; this deflects a portion of the light beam downward at an angle of approximately 40° from the center line of the

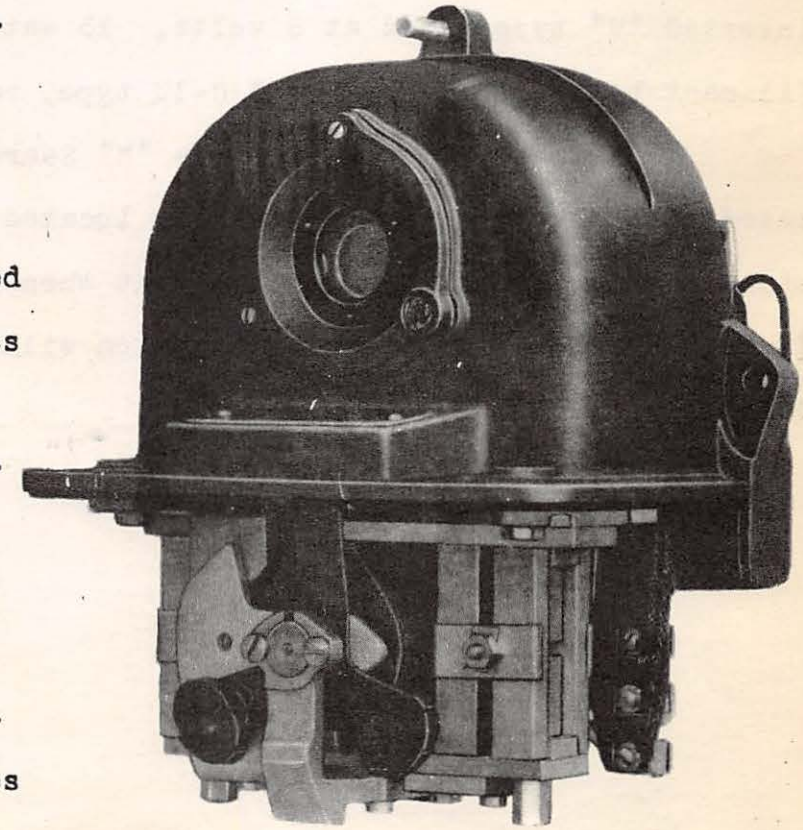


Operating Relay with elliptical reflector and lamp unit removed, exposing the movable roundel holder.

main light beam, for "close-up" view of the indication, when the signal is located above the engineman's line of sight. For the 8 3/8" diameter lens signal, two deflecting prism cover glasses are available for use on curved track, one 10° in one direction only from the center line for moderately curved track, and one 20° in one direction only from the center line for use where the 10° prism is not sufficient. The deflecting prism cover glass with its supporting ring is mounted in front of the standard lens by means of two screws threaded into the standard lens ring in place of the dummy screws used to protect the tapped holes.

Dwarf signals are usually equipped with an 8 3/8" diameter optical lens in combination with a cover glass so as to provide horizontal and upward spread. A 6 3/8" diameter lens and a 20° deflecting prism cover glass, however, is sometimes used.

Other special lenses and deflecting prisms are being employed with satisfactory results to meet certain conditions. A particular instance is in connection with 3 or 5 watt lamps, when a special doublet combination of accurately ground lenses replaces the single lens of the present or moulded type.



Rear View of Operating Relay
(Permanent Magnet Type)

Lamps:

The lamps used in the Style "H" Searchlight Signals are of the S-11 bulb, candelabra bayonet base, C-2 filament, single contact, precision type. Some of the lamps suitable to this service are:

Volts	Watts	Volts	Watts
6	3	10	5
8	5	10	10
6	10	10	18
8	10	* 10	18
* 8	10	11	11

* Double filament type

There is also available a lamp of the above specification having two filaments; the main filament being of the concentrated inverted "V" type rated at 8 volts, 13 watts; the secondary filament being of the straight C-12 type, rated at 10 volts, 5 watts.

Lamps furnished in Style "H" Searchlight Signals are based with the filaments accurately located with respect to the pins in the base. It is obvious that when such a lamp is installed for replacement, the signal indication will remain the same as before.

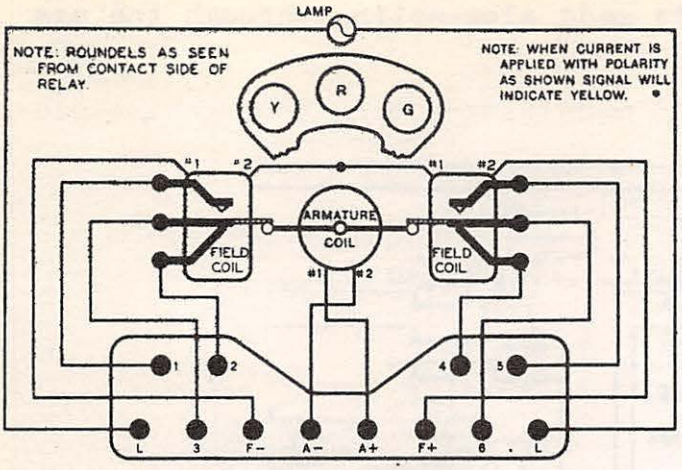


Fig. 2 Diagram of Internal Wiring of Signal with Local Field Coils

Circuits

Circuits for the control of the relay are shown in Figs. 2 and 3. The designations on the terminal board vary to suit the standards established by different railroads. In the typical control circuit for the three position Style "H" Searchlight Signal Fig. 4, it will be noted that the local windings of the operating relay are shown. It will be recognized, when the permanent magnet type of operating relay is used, that no local power connections, except those for the signal lamp, will be necessary.

The controlling circuits include approach lighting of signals. Through the use of this scheme, the power required for lighting is reduced and the inclusion of the approach lighting relay contact in the slow acting relay control circuit prevents the signal in the rear showing a momentary green indication when a high speed light engine passes the advance signal; i.e., three relays would have to pick up successively before the track relay for the ad-

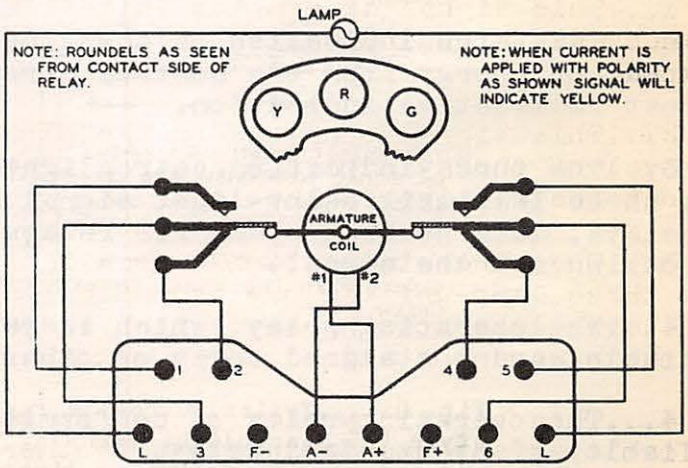


Fig. 3 Diagram of Internal Wiring of Signal with Permanent Magnets

vance block shunts. Relay 19ER is made slow-acting through the use of a copperoxide snub.

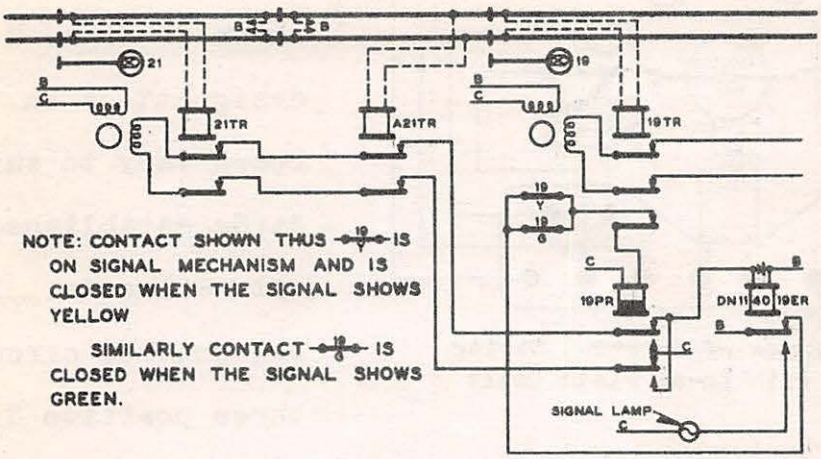

21
19
21TR
A21TR
19TR
NOTE: CONTACT SHOWN THUS 19 Y IS ON SIGNAL MECHANISM AND IS CLOSED WHEN THE SIGNAL SHOWS YELLOW
SIMILARLY CONTACT 19 G IS CLOSED WHEN THE SIGNAL SHOWS GREEN.
19PR
DN11 40 19ER
SIGNAL LAMP

Fig. 4.....Typical Circuits for Two-Block Indication Style "H" Searchlight Signals. Mechanisms controlled and operated by polarized line circuit. Signals approach lighted through one block in the rear.

Summary of Features:

The foregoing detail description of the Union Style "H" Searchlight Signal may be summarized in sixteen (16) brief statements which call particular attention to the outstanding advantages.

1...This signal is compact in design and requires minimum clearances as three indications can be projected through the same lens area.

2...This signal operates on the closed circuit principle, as removal of energy from the control circuit causes it to assume its most restrictive indication.

3...The three-indication searchlight signal is the equivalent of a three lamp-unit color-light signal and requires fewer control relays, less housing space for relays and less wiring between the housing and the signal.

4...The operating relay, which is part of the signal, is as reliable as any standard relay or other signal equipment.

5...This signal permits of uniformity in height of poles and uniformity of signal indications.

6...This signal is designed with a highly efficient optical system which projects intense light indications.

7...One low-wattage lamp is used for the three indications.

8...A constant voltage is imposed on the low-wattage lamp, due to the elimination of the usual lamp-controlling contacts.

9...The integrity of the lamp circuit does not depend upon the closing of relay contacts, except where approach-lighting is used.

10...A false phantom color indication is impossible because any light projected through the signal is reflected by the mirror and must pass through the colored roundel to get out through the optical system.

11...As the position of the colored roundels is controlled by the condition of the block, the indication will always be of the proper color.

12...The dwarf signal uses the same size lens and same operating relay as the high signal, the mechanism cases only differing in the method of mounting and adjusting.

13...Convenient adjustments are provided for aligning both high and dwarf signals.

14...In terminal areas the Searchlight dwarf signals provide the same indications as the high signals. This permits their use at track clearance points without the expense of constructing signal bridges and thus greater facility for train operation and economy of installation are provided by their use.

15...The "Union" Style "H" Searchlight Signal is a universal signal.

16...The economy of the "Union" Style "H" Searchlight Signal has been increased materially by the use of a permanent magnet field until now it only requires about two-thirds of the electrical energy formerly required and less wiring for its operation.

SEE U.D. 200 FOR

LATER INFORMATION